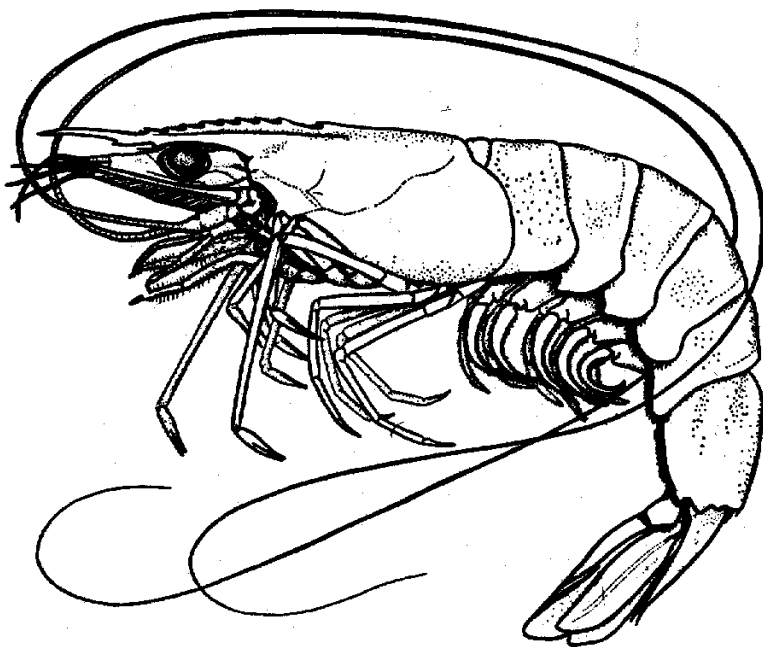


THE SHRIMP AND THE SHRIMP FISHERY OF THE SOUTHERN UNITED STATES



**UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES**

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THE SHRIMP AND THE SHRIMP FISHERY OF THE SOUTHERN UNITED STATES

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The shrimp fishery of the United States is centered primarily in the eight South Atlantic and Gulf States (North Carolina to Texas), where about 216 million pounds of heads-on

shrimp valued at about \$69 million to the fishermen were taken in 1963. It ranks first in value of all the fisheries of the United States.

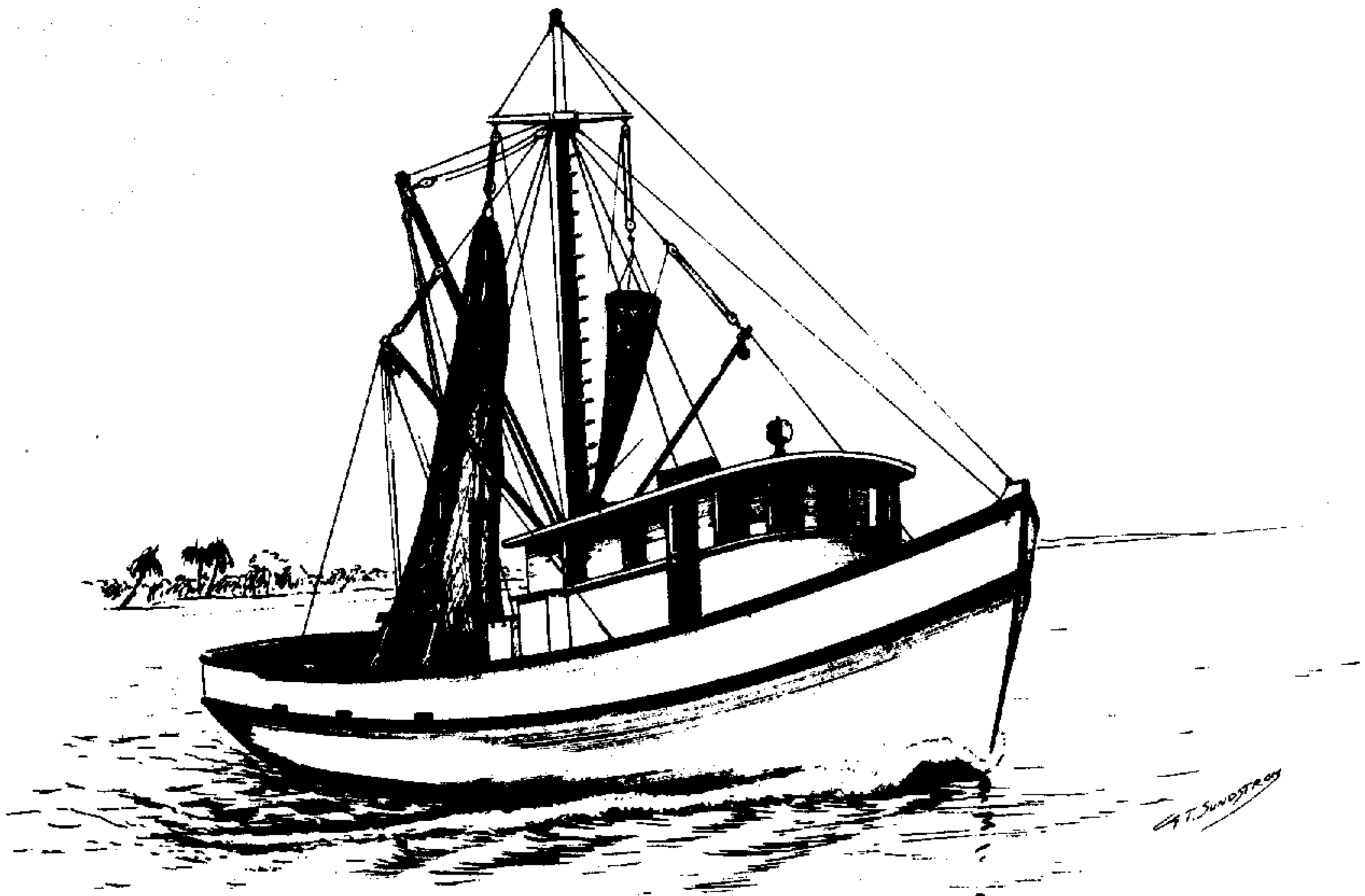


Figure 1.--Gulf of Mexico medium sized shrimp trawler.

Three species of shrimp, all members of one family (Penaeidae), are of the greatest commercial importance. Separation of the catch by species in recent years indicates that the common or white shrimp (Penaeus setiferus) is no longer the dominant species in the catches; in 1963 it contributed about 36 percent of the catch in the Gulf of Mexico and about 48 percent along the South Atlantic, whereas the brown shrimp (Penaeus aztecus) comprised about 44 percent of the catch in the Gulf and about 48 percent along the South Atlantic. The pink or brown-spotted shrimp (Penaeus duorarum) yielded about 19 percent of the Gulf catch (largely in the Tortugas area) and 4 percent of the South

Atlantic production (largely in North Carolina).

Two other shrimps are of minor importance. The sea bob (Xiphopenaeus kroyeri), is taken mainly in Louisiana and comprises only about 1 percent of the catch. Exploratory fishing by the U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries, has indicated commercial concentrations of another species, the royal red shrimp (Hymenopenaeus robustus), in deep waters off the Continental Shelf in the Gulf and South Atlantic regions. These royal red shrimp occur from about 175 to 300 fathoms and have not as yet been fished extensively, although a few vessels are working the grounds to a limited extent.



Figure 2.--Catch of royal red shrimp from about 175 fathoms off east coast of Florida, on deck of Bureau's M/V Silver Bay. (Photo by Exploratory Fishing and Gear Research Station, Brunswick, Ga.)

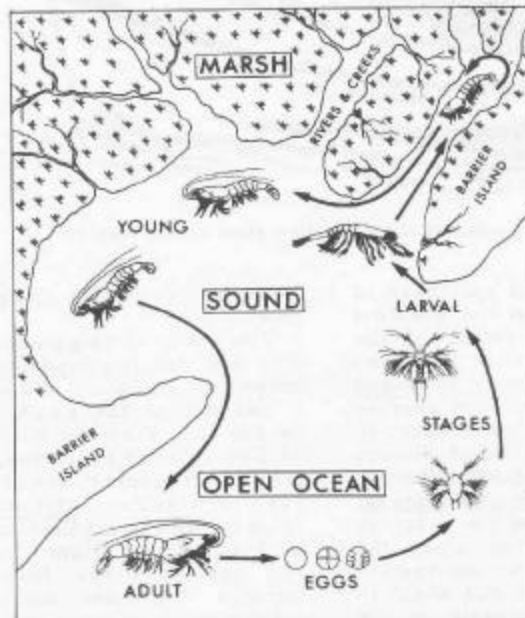


Figure 3.--Diagram of the life cycle of white shrimp (after Anderson and Lunz 1965).

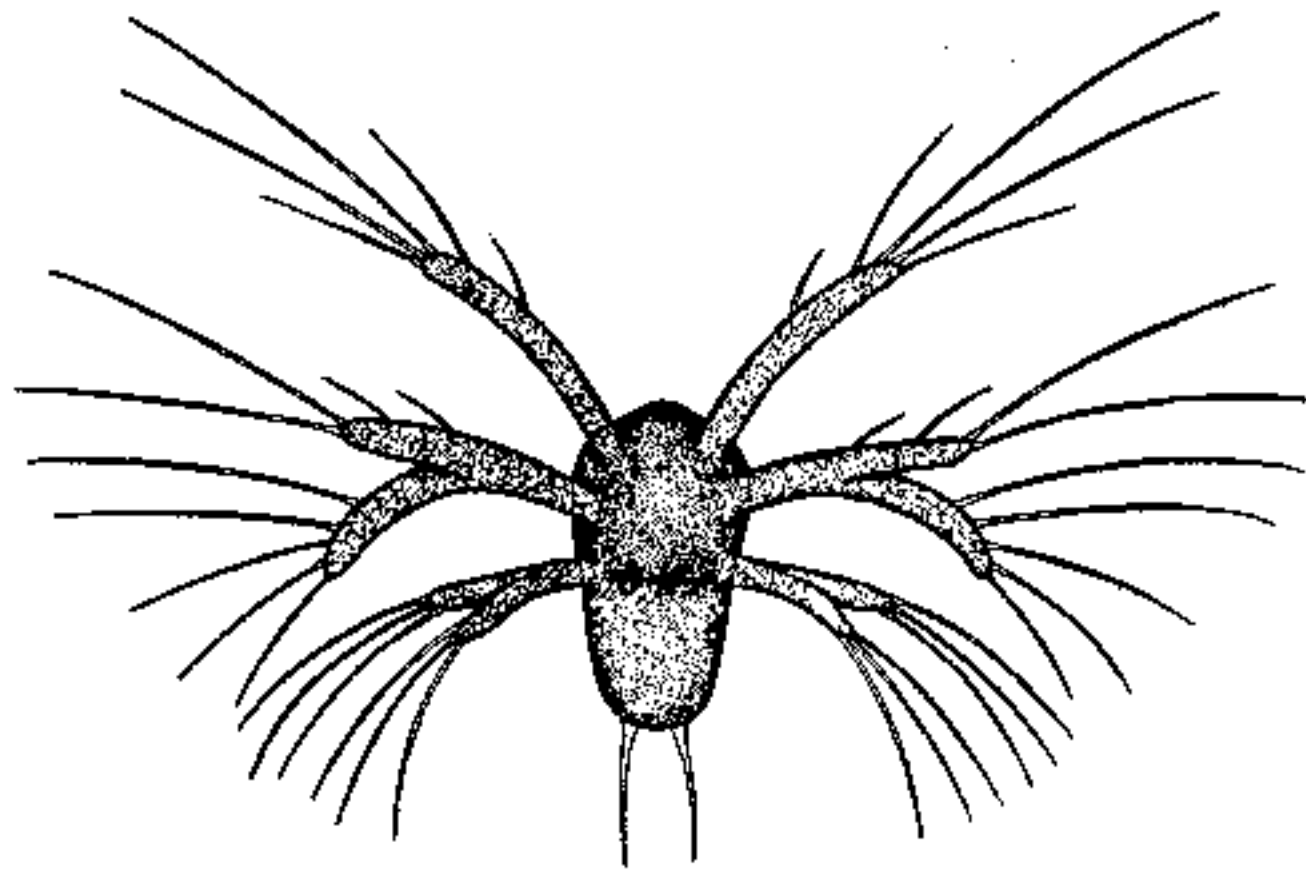


Figure 4.--Larval white shrimp shortly after hatching; first nauplius, about 1/85-inch long (after Pearson 1939).

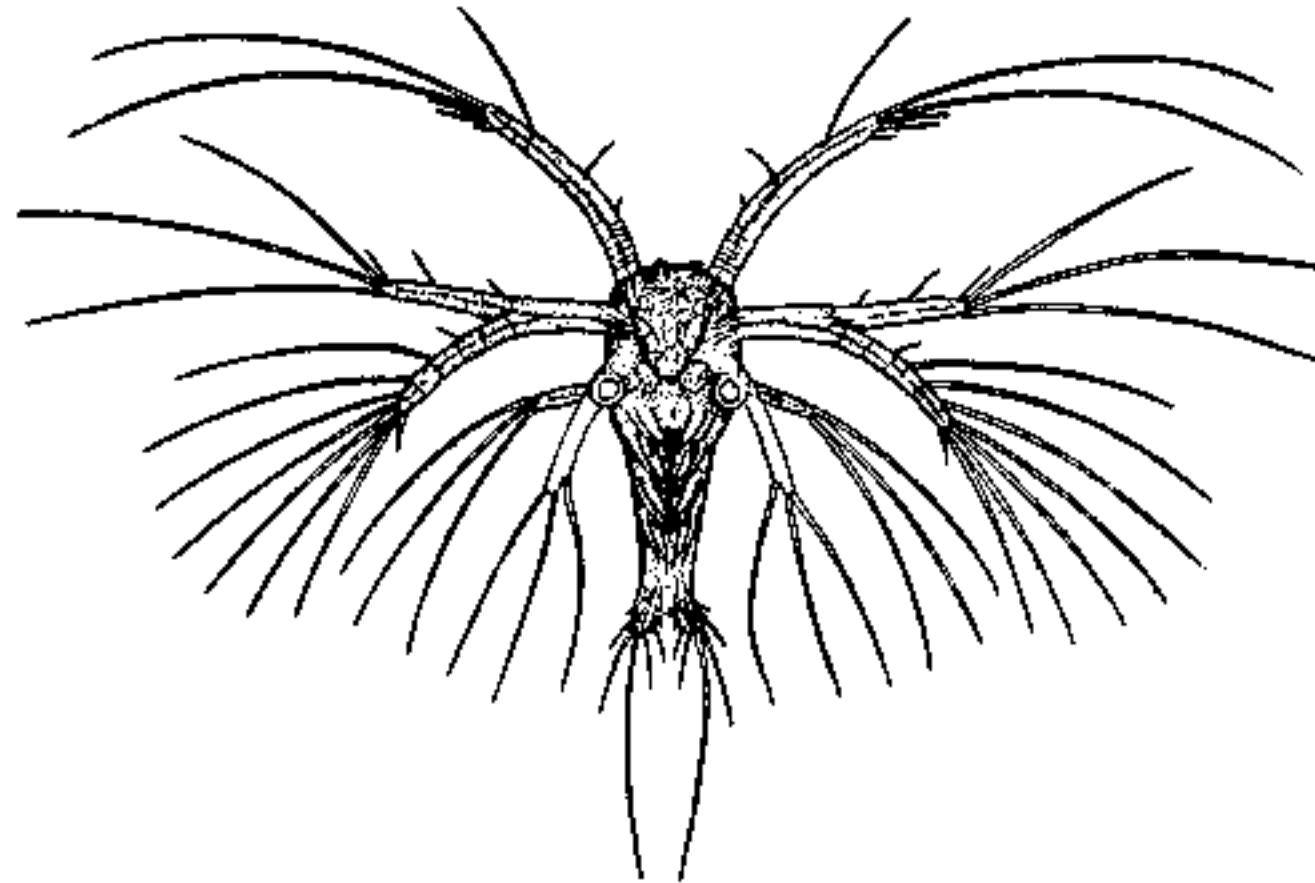


Figure 5.--Larval white shrimp about 1 day after hatching; fifth nauplius, about 1/45-inch long (after Pearson 1939).

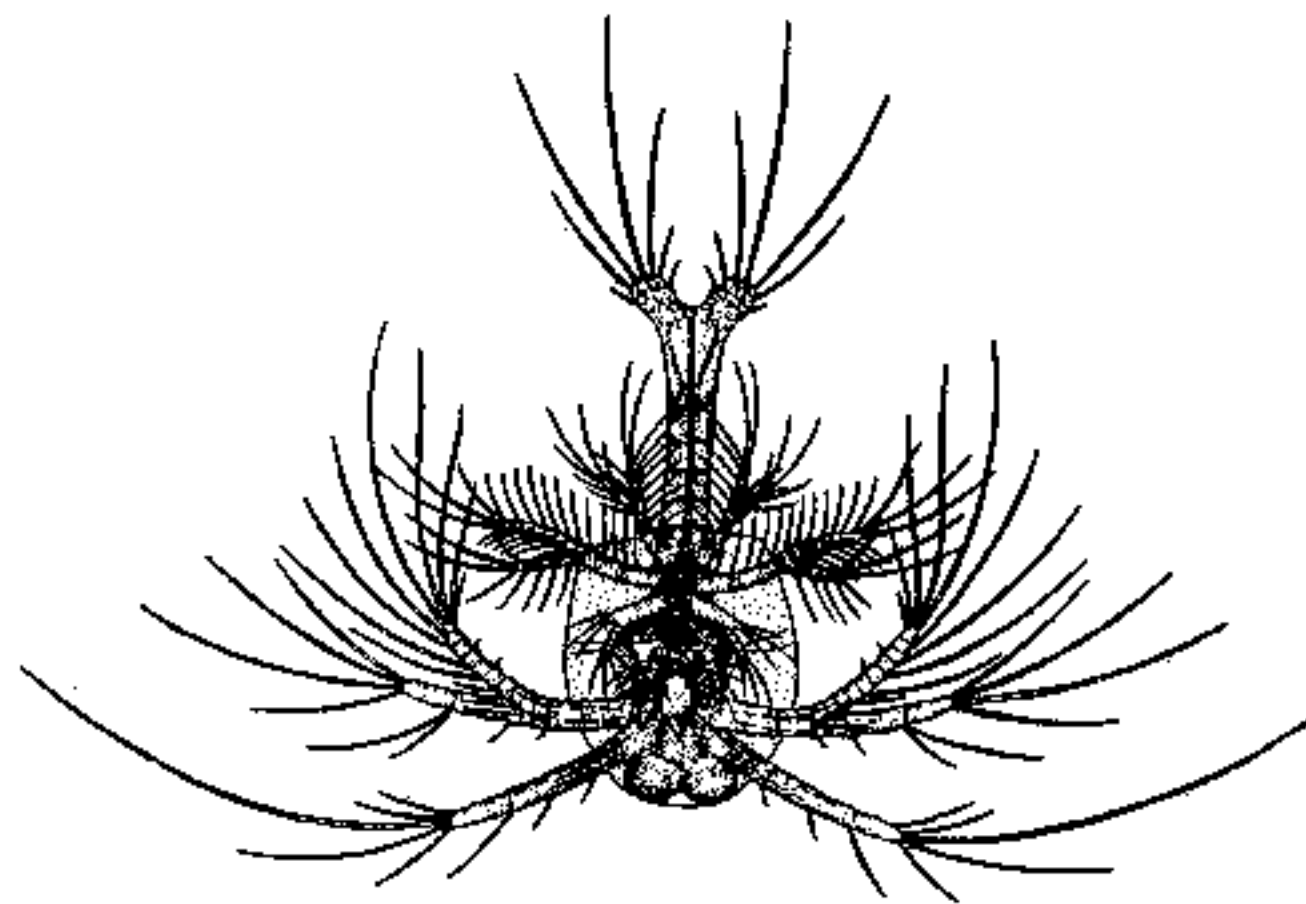


Figure 6.--Larval white shrimp about one to 1 1/2 days after hatching and fifth naupliar molt; first protozoa, about 1/28-inch long (after Pearson 1939).

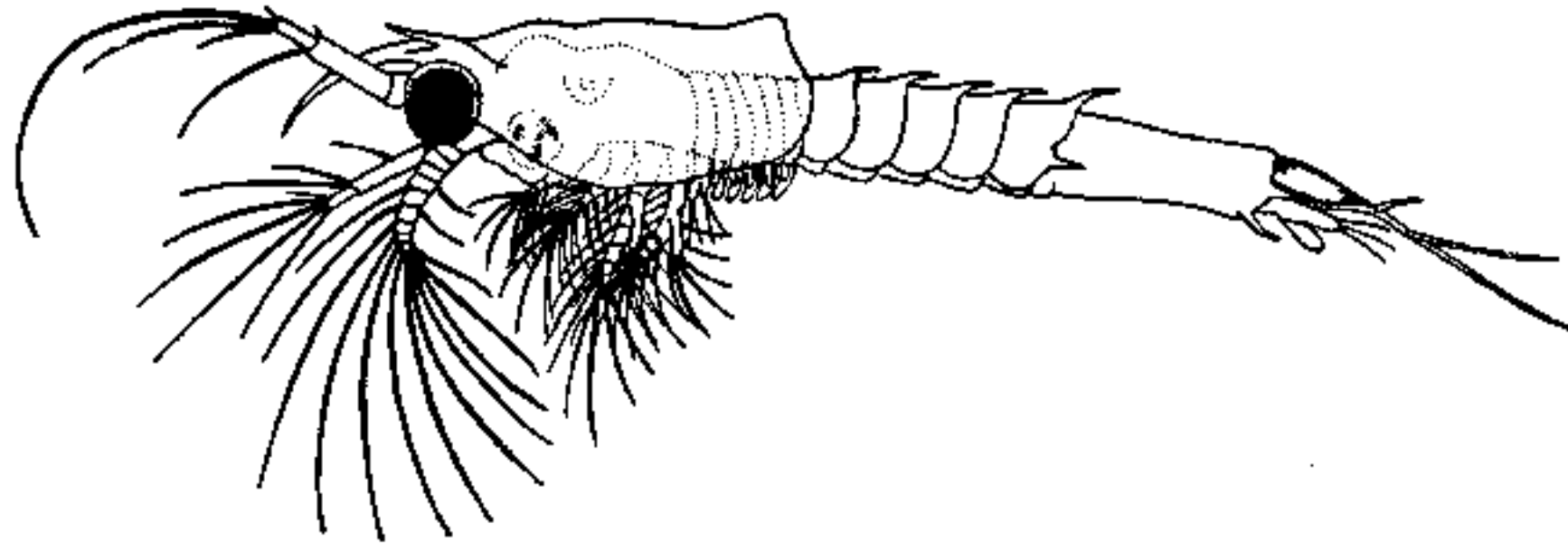


Figure 7.--Larval white shrimp; third protozoa, about 1/10-inch long (after Pearson 1939).

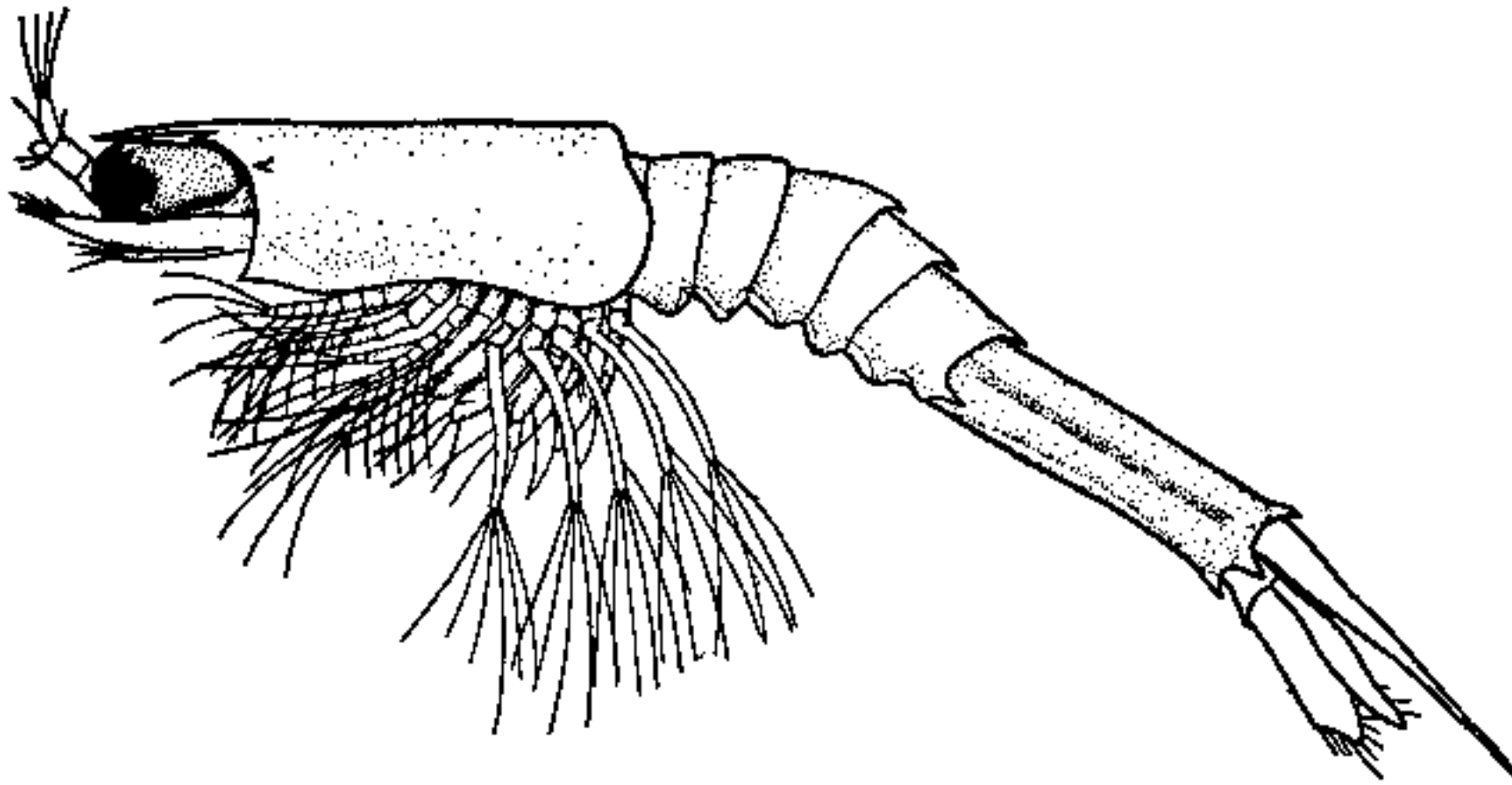


Figure 8.--Larval white shrimp; first mysis, about 1/8-inch long (after Pearson 1939).

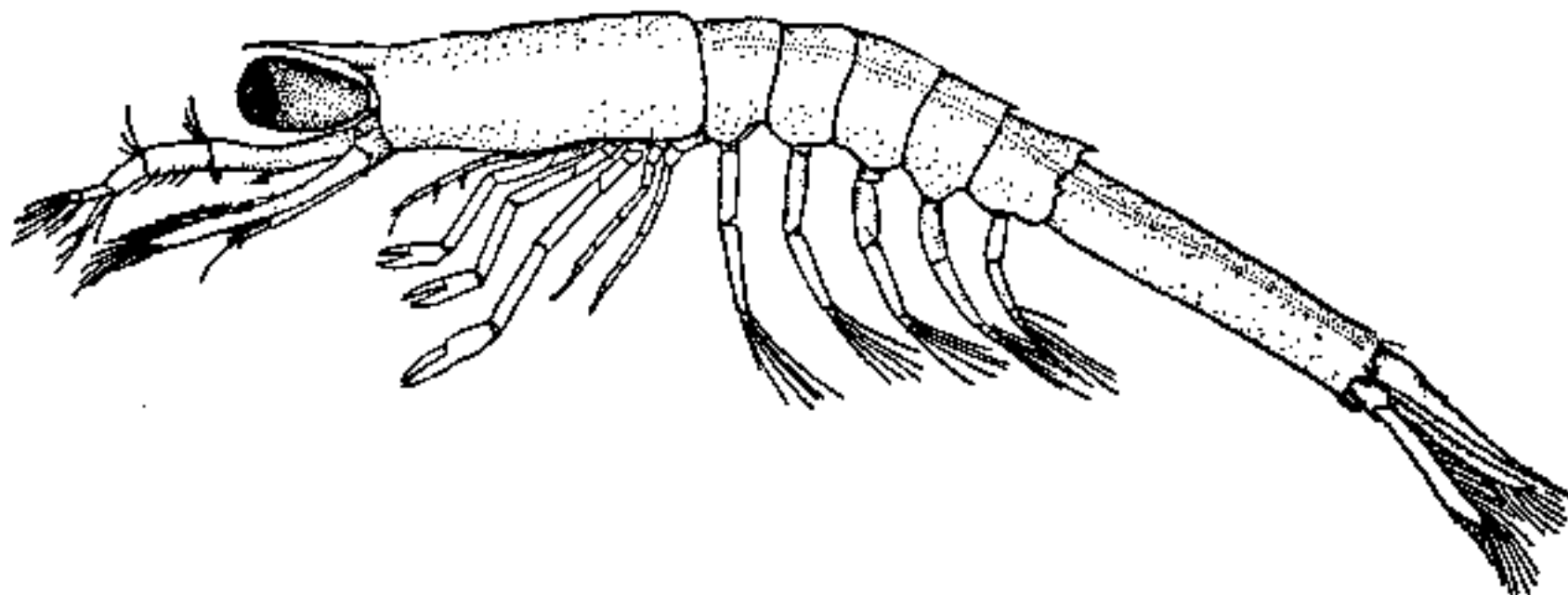


Figure 9.--Larval white shrimp about 15 to 20 days after hatching; second postlarva, about 1/5-inch long (after Pearson 1939).

young shrimp is only about 1/5 of an inch long and is still planktonic. During this period of early development the young shrimp have moved from the saline offshore spawning area to the brackish inside marshes, bays, and estuaries. Upon reaching these "nursery grounds" they adopt for the first time (it is believed) a benthic or bottom existence.

Young shrimp

Young shrimp about 1/3 of an inch long are found during the spring and summer in the brackish inside areas which serve as their nursery grounds. This habitat is a rich feeding ground characterized by shallow water, muddy bottoms, rather widely fluctuating seasonal temperatures, and moderate to low salinity.

As the young grow, they move from the shallow waters of the marsh, bayou, and lagoon into the deeper creeks, rivers, and bays, making their first appearance on the inside fishing grounds when about 2 inches long. The young first appear in the estuarine fishing grounds in June or July, depending upon the area, and by July or August they have begun to appear in outside waters. The estuarine waters generally contain all sizes of shrimp; smaller shrimp occur in the waters farther inland and larger shrimp in waters nearest the open ocean. These differences in size appear to depend more on locality than salinity.

Growth

Growth is rapid during spring, summer, and early fall, and negligible in the winter. The periods of rapid and slow growth appear to be associated with temperature; if so, we could expect growth to vary somewhat from year to year and with locality. A general statement of growth is further complicated by the fact that shrimp of different sizes grow at different rates. We believe that shrimp reach a little over 3 inches (80 mm.) in length (from tip of rostrum to the end of telson) about 2 months after spawning. On this basis and from established growth rates, an example of growth is presented: Spawning on May 1; young shrimp reach a length of a little over 3 inches (approximately 80 mm.) by July 1, 4-1/3 inches (110 mm.) by August 1, 5 inches (130 mm.) by September 1, 5-3/4 inches (145 mm.) by October 1, and about 6-1/5 inches (158 mm.) by November 1; growth from November 1 to March 1 is negligible, but if we assume 1/12-inch (2 mm.) growth during this period, our shrimp average about 6-1/3 inches (160 mm.) long on March 1, the beginning of the spring rapid growing season; they reach a length of about 6-2/3 inches (168 mm.) by April 1 and almost

7 inches (173 mm.) by May 1; they are now about 1 year old, mature, and will spawn during this spring season. Because the spawning season covers a period of about 6 months, any number of combinations of growth are possible, depending on the month of spawning.

Migrations

The white shrimp has very definite patterns of movements, but they vary in different areas.

In one respect the movements are similar in all localities--after the young shrimp first make their appearance on the inland fishing grounds they gradually work their way towards the sea. Once the shrimp have reached the outside waters their movements vary with the size of the shrimp, the locality, and apparently also the time of the year. Small shrimp 130 mm. (about 5 inches) or less in total length do not seem to undertake any extensive movements. The large shrimp, more than 130 mm. long, show distinct behavior patterns which vary with locality.

On the Atlantic coast, the bulk of the white or common shrimp, after migrating from inshore to offshore waters, do not move into very deep water far from the coast. Instead, they move parallel to the shoreline with the seasons--southward during the fall and early winter and northward in late winter and early spring. In our tagging experiments, the longest southward migration was by a shrimp released in North Carolina in October and recaptured 95 days later off the east coast of Florida--about 360 miles south of where it was released. The greatest northward migration was by a shrimp released in central Florida in January and recaptured 168 days later about 260 miles to the north, off the coast of South Carolina.

Along the Louisiana coast west of the Mississippi River the large shrimp move offshore and scatter during the fall and winter. At all times they seem to be drifting about, like cattle on open range land. The only definite patterns seem to be offshore and onshore movements, which evidently are associated with temperature changes and spawning, and a tendency to concentrate in certain areas, probably because of better feeding conditions. We believe the more or less aimless wanderings of the shrimp (but not the offshore and onshore movements) represent a search for food. There appears to be a natural barrier at the Mississippi River for no tagged individuals crossed east to west or west to east.

West of the Mississippi River a possible movement of shrimp from central and southern Texas to the coast of Mexico is indicated during the fall and early winter, probably comparable to the movement along the South

Atlantic coast of the United States. Likewise, there is evidence of a south-to-north migration in the spring from northern Mexico to Texas.

Longevity

Mortality of shrimp is apparently high, and the number that live more than 1 year is a small percentage of the total population and is probably not of great importance. Some shrimp live at least 16 months and possibly longer, but as far as the fishery is concerned the common or white shrimp can be considered an annual.

Food

The shrimp is omnivorous--it eats plant detritus, worms, crustaceans, and small mollusks. Mud and sand also can be found in its intestinal tract. In aquaria it has been observed to attack and devour small fish and other shrimp. A shrimp is particularly susceptible to attack from another member of the same species during the process of molting, when the old shell has been discarded and the new one is still soft.

Miscellaneous

The shrimp, like other crustaceans, wears its skeleton on the outside of the body and in order to grow must cast off this shell and replace it with a new and larger one. The frequency with which these shells are cast is not known, but with young shrimp during the season of rapid growth the interval between molts appears to be relatively short. In the process of shedding, all of the hard structures of the shrimp are cast off and renewed.

The white shrimp swims forward by the use of the pleopods or abdominal feet. When frightened or when rapid movement is required the shrimp, with a flip of the abdomen, can propel itself backward with remarkable speed. This flexing of the powerful muscular abdomen also enables the shrimp to leap clear of the water.

NUTRITIVE VALUE OF SHRIMP

Shrimp possess the same general food properties that are commonly attributed to fishery products. In general, marine products are an excellent and economical source of highly digestible proteins, a good source of vitamins, and an excellent source of minerals in quantity and variety. Shrimp are unusually rich in minerals and contain a high natural content of iodine. As a consequence, shrimp like other marine foods are ideal for those areas in which goiter is prevalent. It is well

known that iodine deficiency in the diet is the cause of the most common type of goiter. Shrimp also contain vitamins A and D.

IODINE SHRIMP

Shrimp occasionally possess iodoform odor (the typical odor associated with hospitals) which is commonly thought to be caused by preservatives put on the shrimp. On the contrary this condition occurs because the shrimp has eaten various marine organisms which impart the odor. Croakers and other bottom-living fish frequently possess this same iodoform smell, which is undoubtedly caused by a source similar to that of the shrimp. Although possibly unpleasant, it is not harmful.

METHODS OF CAPTURE

Until the otter or shrimp trawl was introduced some time between 1912 and 1915, the most efficient gear for catching shrimp was the haul seine. At about that time, the Bureau of Fisheries, at its station in Beaufort, N.C., had been using a small otter trawl to collect marine forms. Fishermen, noting that shrimp were being taken by these nets, adopted the idea, and constructed larger trawls for use in the commercial shrimp fishery. Apparently, the first shrimp trawling took place at Fernandina, Fla. Use of the trawl spread rapidly throughout the south Atlantic and Gulf regions, and by 1917 trawls had become the standard commercial gear.

The haul seine fishery gradually disappeared after the trawl was developed and put in widespread use. Louisiana was the last locality in which the seine was employed. During the early 1930's, a few seines were still being used, but they dropped out one by one until at present none appears to be in operation, and the trawl remains as the exclusive gear for commercial operations.

Introduction of the trawl completely revolutionized the shrimp industry. Whereas the haul seine could be used only in shallow water, required a large crew of men, and could be operated for only a limited time during the summer and fall, the shrimp trawl was adaptable for use over a much greater range, could be operated with fewer men, yielded a greater production per man, and was a much more efficient type of gear. Its introduction opened up entirely new grounds and led to a rapid expansion of the fishery.

The size of trawls now in use varies from the 10-foot try net, used for locating schools of shrimp, to the vessel's main trawl which may have a spread of 120 feet at the mouth. Its dimensions depend largely on the size and

power of the vessel. A recent innovation is the use of two smaller trawls (about 40 feet), one on each side of the vessel, instead of one larger trawl.

Fishing for white shrimp is almost entirely during daytime, whereas trawling for the brown and pink shrimps is a nighttime operation.

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